

# **Validation of HIRDLS Observations of Clouds and Aerosols**

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## Outline of Talk

**Brief review of retrieval methodology**

**Discuss retrieval of aerosol/cloud extinction  
for wide range of measured extinction**

**Cirrus**

**Background aerosol**

**Conclusions**

## Retrieval Methodology



$$R = \int B e^{-\tau} d\tau \quad \text{with} \quad d\tau = d\tau_{\text{gas}} + d\tau_{\text{aerosol}}, \quad d\tau_{\text{aerosol}} = \beta ds$$

**Normal processing:** Apply maximum-likelihood estimation retrieval technique (Rodger's formalism) – at altitudes above the cloud top

**Special processing:** Retrieve model-independent profiles of  $\tau_{\text{aerosol}}$  ( $\text{m}^2 / \text{mole}$ ) for HIRDLS channels 1,6,9,13,19 at all altitudes

Specify  $\tau_{\text{gas}}$  by interpolation of monthly averaged Mozart climatology. 1d SAGE aerosol profile is the a priori at all latitudes.

Convert profiles to  $\text{km}^{-1}$  units using pressure - temperature profiles

## Cirrus Validation

**CR-AVE, Costa Rica  
WB-57 in-situ sampling  
February 2, 2006**

**CAPS : in-situ cloud particle size distributions**

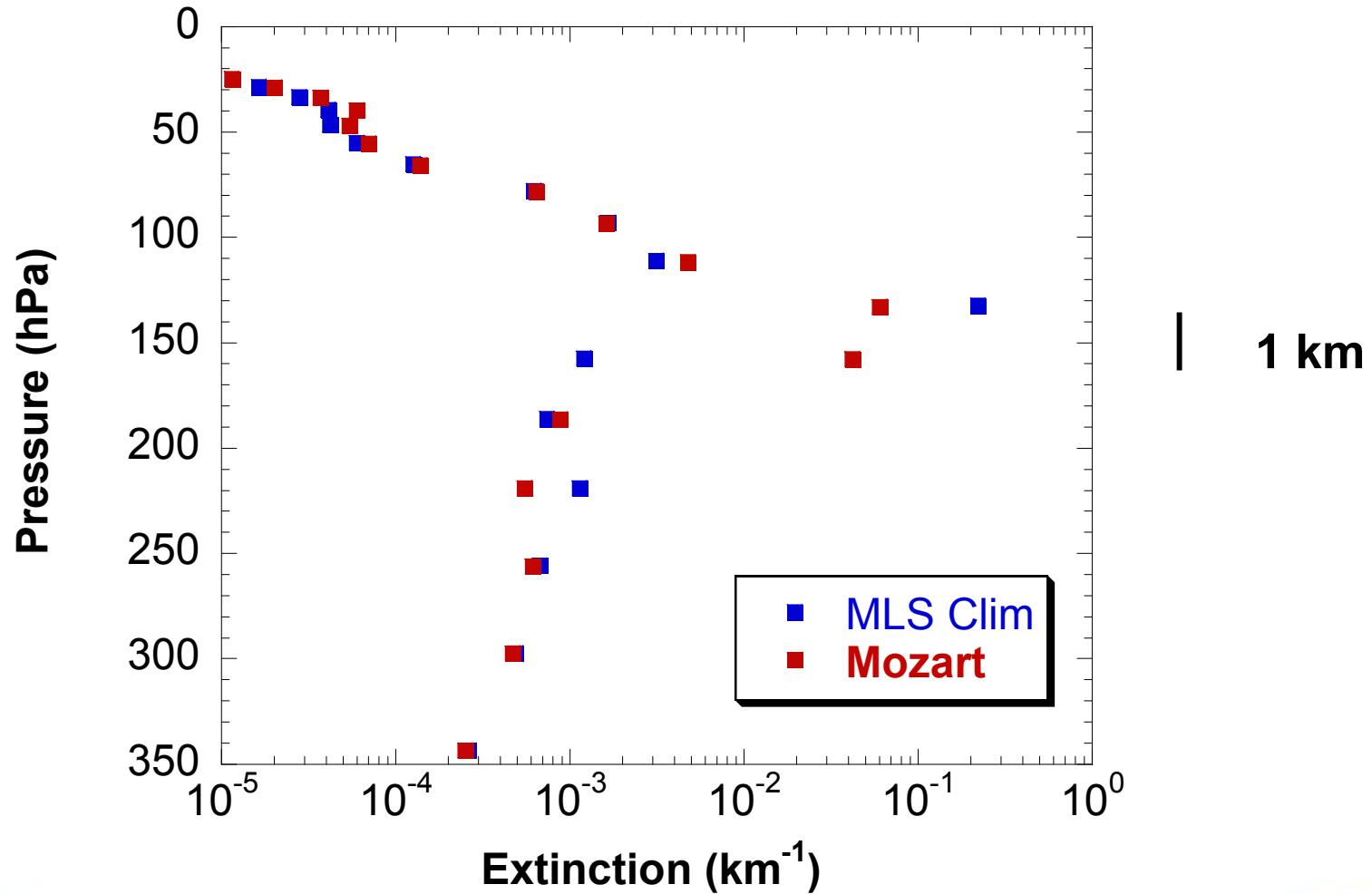
# Vertical Gradient of Extinction is Very Large



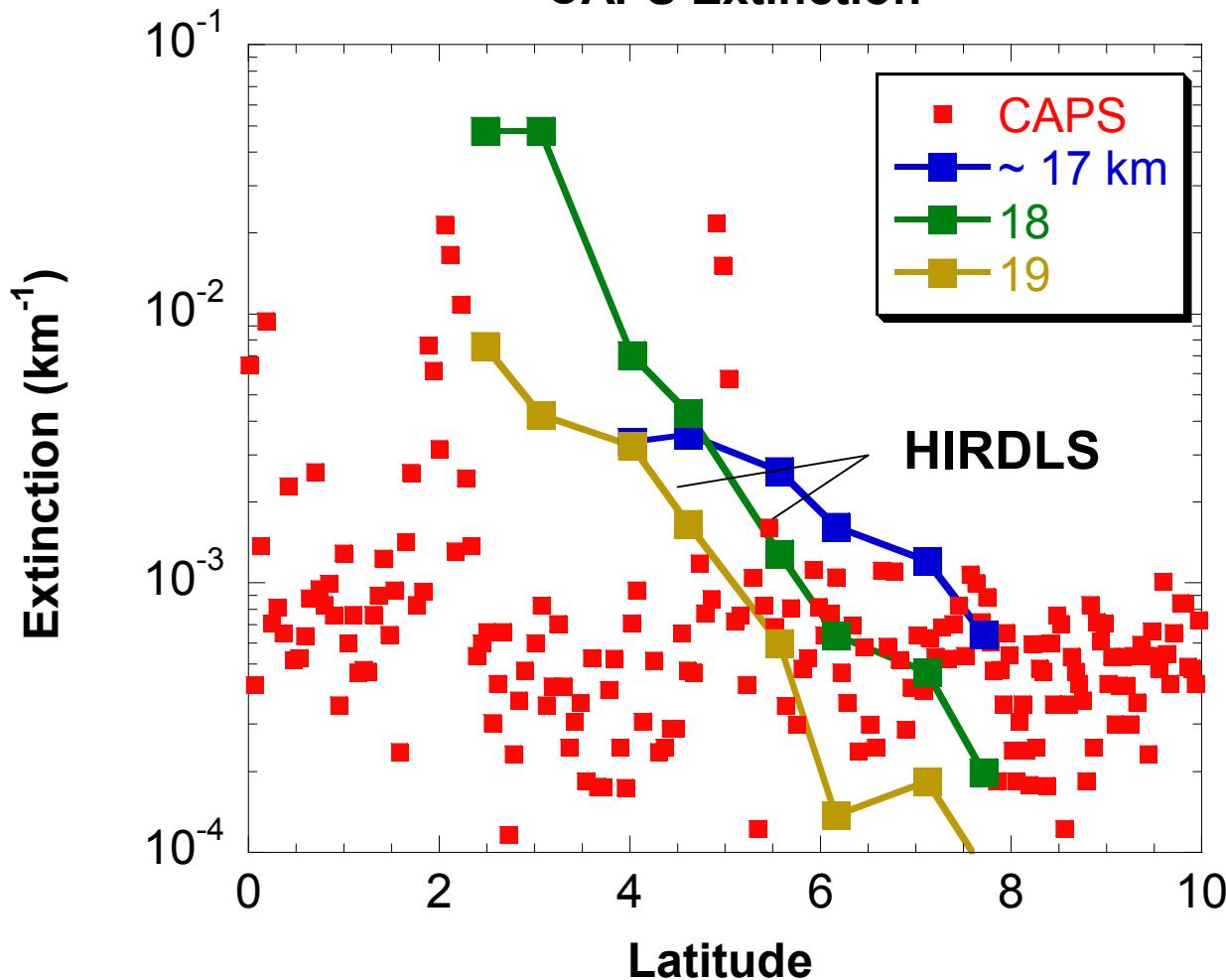
CR-AVE February 2, 2006

HIRDLS Ch 6 (12  $\mu\text{m}$ )

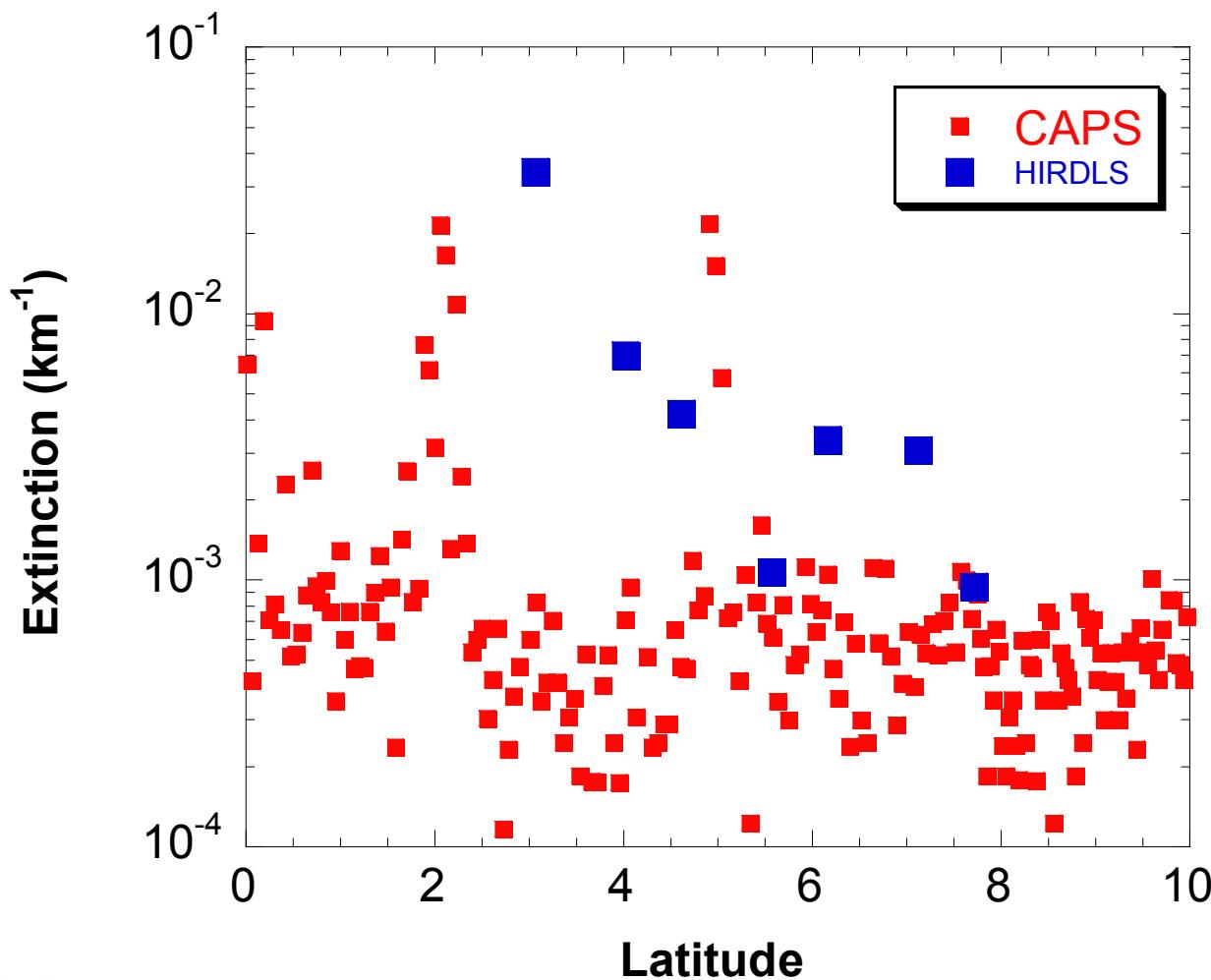
Lat 6, Lon -86, Prfid 5349



## CR-AVE February 2, 2006 CAPS Extinction



## CR-AVE February 2, 2006 CAPS Extinction



match  
aircraft and  
HIRDLS  
pressure  
values

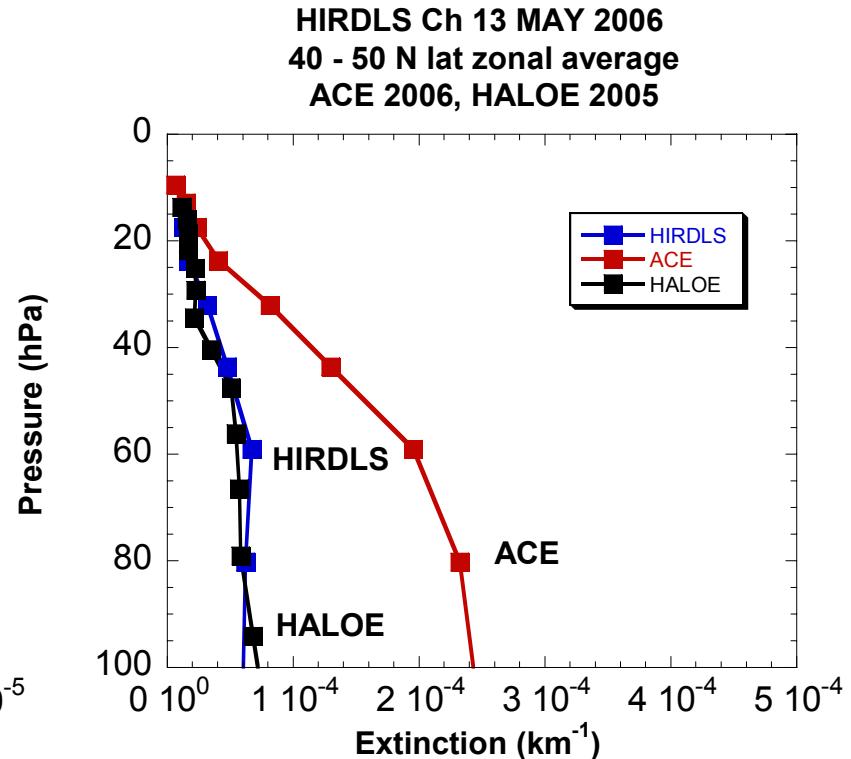
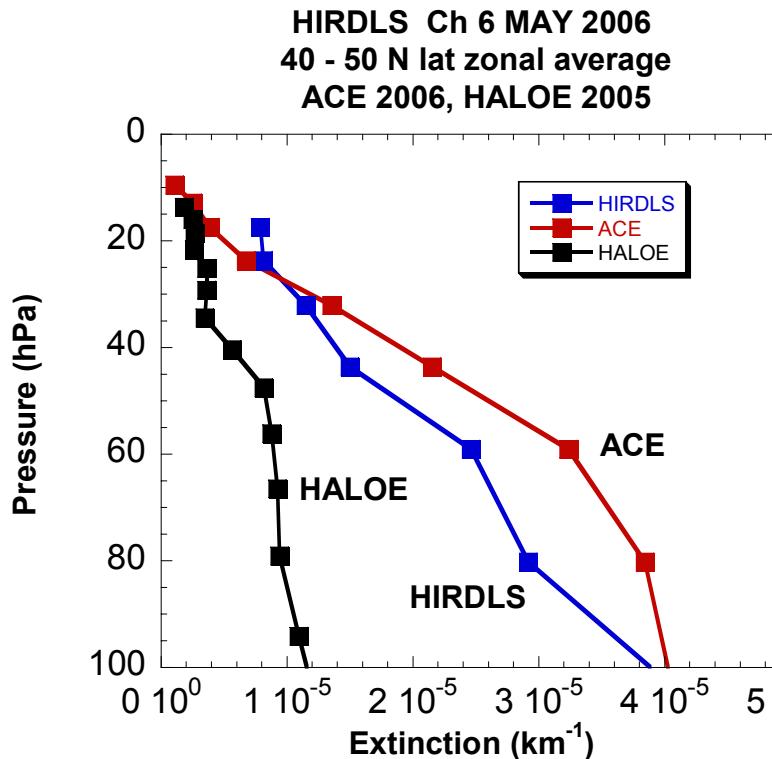
## Background Aerosol

**Extinction ( $\beta$ ) of background sulfate layer is very low**

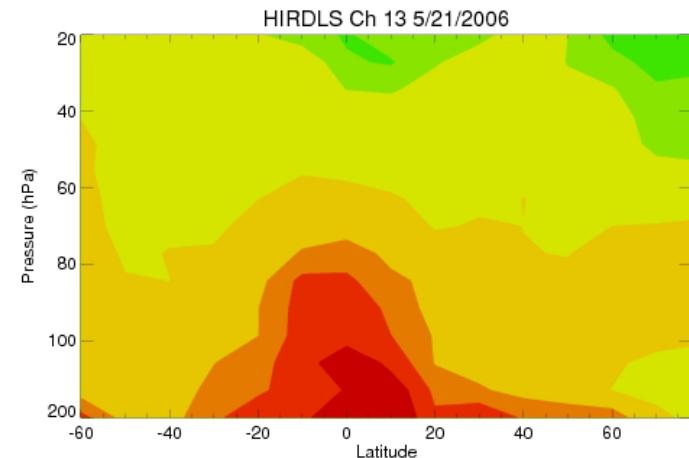
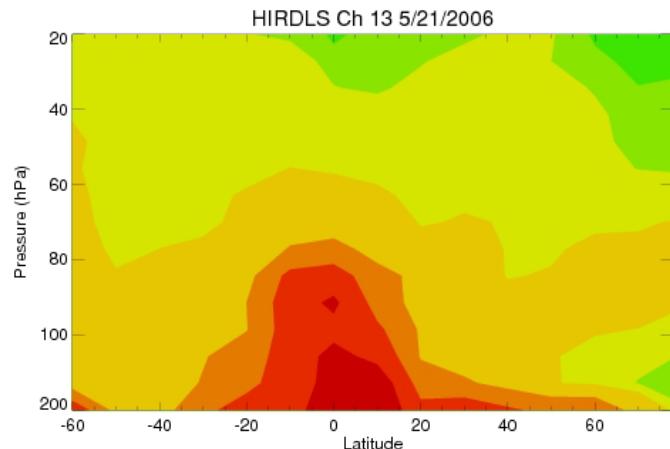
**Previous comparisons with correlative measurements  
agreed to factor of 2  
HIRDLS  $\beta$  > correlative data**

**Acknowledgment: ACE science team, Tony Strawa,  
Reeves and Wilson (DU), HALOE science team**

# ACE – HIRDLS Zonal Averages



# 10% Sensitivity to Climatology



**Mozart Climatology**

**MLS Climatology**

May 21, 2006, Ch 13, zonal average  
 $0.001 < (\beta \text{ precision} / \beta \text{ extinction}) < 50\%$

## Conclusions

**HIRDLS measures extinction ( $\beta$ ) over a wide range of extinction – factor of 1000**

**Quantitative agreement – factor of 2 to 3**

**Cloud extinction validation**

- difficult in-situ measurement
- cirrus  $\beta$  field has very large vertical gradient !

**HIRDLS “kapton” correction improvements will improve the magnitude and wavelength dependence of the background aerosol extinction spectrum**